

A new vole of the *Clethrionomys rufocanus* group  
from Rishiri Island, Japan

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In the early summer of 1965, while collecting small mammals at Rishiri Island, north western Hokkaido, Japan, the author found out that there are two distinct forms of large red backed voles, evidently belonging to the *Clethrionomys rufocanus* group, in the tiny island. The one was mostly collected from open grass field and similar to *C. r. bedfordiae* (THOMAS, 1905), the common vole of Hokkaido, in external and cranial characters except of decidedly larger dimensions and dental characters. This vole may be conspecific with *C. sikotanensis* (TOKUDA, 1935) from Shikotan Island which probably constitutes a lineage slightly earlier in the expansion or emergence in the course of evolution, that is more primitive, than *bedfordiae*. The other one was mainly captured in coniferous forests at the foot of Mt. Rishiri and distinguished superficially from the former by larger size, relatively long tail and darker mantle. As the cranial and dental characters of this form are evidently different from all of the known forms of *Clethrionomys*, this form is described as a new species as follows:

*Clethrionomys rex* sp. nov.

1961. *Clethrionomys sikotanensis*: IMAIZUMI, Coloured Illustrations of the Mammals of JAPAN, 131-132 (*Partim, nec* TOKUDA, 1935)

Holotype: M 10823 ad. male, collected from Kanrosen, Mt. Rishiri, Rishiri Island, Hokkaido, in 29, June, 1965, by Yoshinori Imaizumi, Mizuko Yoshiyuki and Iwao Obara, preserved in Dept. Zoology, National Science Museum, Tokyo.

Paratypes: 8 ad. and old males, M 10823, 10827, 10841, 10882, 11032, 11161, 11645, 11863, and 7 ad. and old females, M 7216, 10815, 10824, 10825, 10828, 11868, 11864 in the collection of National Science Museum, Tokyo.

Diagnosis: Similar to *Clethrionomys rufocanus* (SUNDEVALL, 1846) and *C. sikotanensis* (TOKUDA, 1935) in general aspects, but evidently larger, head and body  $135 \pm$ , condylobasal length of skull  $30.5\text{mm} \pm$ , mantle darker, auditory bulla relatively small, lateral bridges of palatine incomplete, and third upper molar with three deep reentrant and four prominent salient angles both on inner and outer sides.

Description: Size very large, in 8 ad. and old males head and body 123.5-149, tail 49.5-63, condylobasal length 29.7-32.2mm, instead of respectively 95-120, 42-55, 26.8-28.8mm in *sikotanensis* from Shikotan Island. Summer pelage duller and more yellowish than *bedfordiae*; upper surface of head and body tawny-olive with a large smoke gray lateral patch on both sides of rump, top of head and anterior neck just behind ear conch bright clay color, mid-dorsal region from nape to rump slightly darker and nearly snuff brown forming an indistinct mantle rather similar to that of

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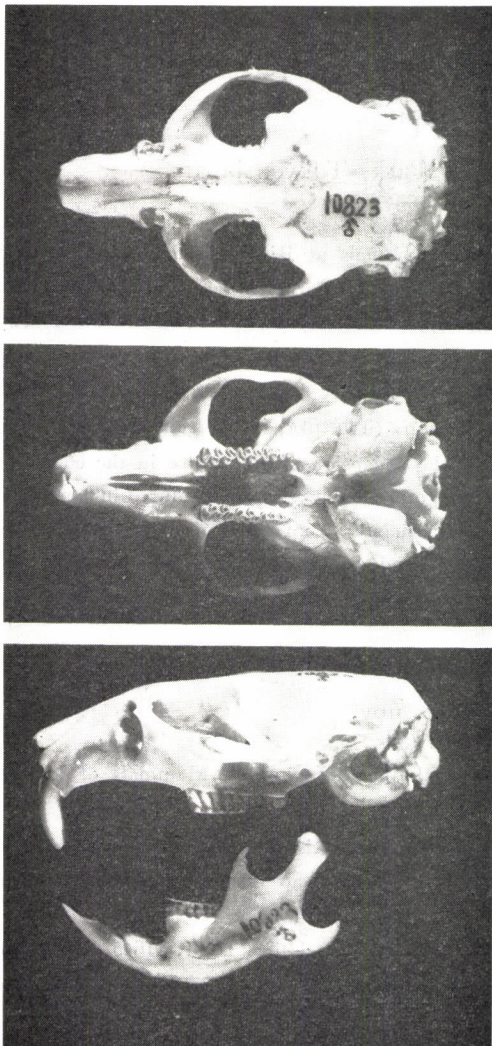


Fig. 1. Dorsal, ventral, and lateral aspects of skull of the type of *Clethrionomys rex*.

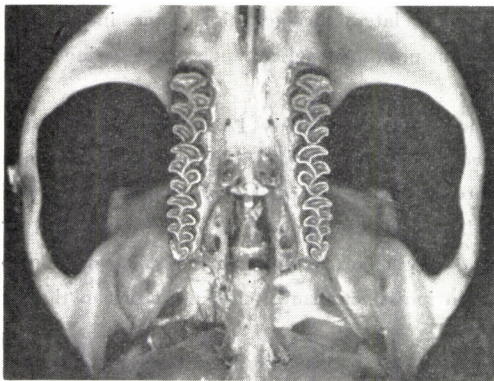


Fig. 2. Lateral bridges of palatine in the type of *Clethrionomys rex*.

*bedfordiae* but not so reddish, ventral surface dull white washed by pinkish buff, base of hairs both of dorsal and ventral sides dark mouse gray; back of manus and pes dirty white, upper surface of tail dark brown, ventral surface whitish, demarcation distinct, pencil less distinct.

Skull massive, with relatively small braincase and long muzzle, an evident concavity on anterior border of zygomatic root in dorsal aspect; superciliary ridges widely separated even in old age, temporal ridges on braincase clearly defined, interparietal rather small in transverse width; lateral bridges of palatine incomplete and not fused with maxilla even in very old individuals: auditory bulla relatively small, ratios of its length to condylobasal length vary from 24.54 to 25.76 in about 95.45 per cent of the population ( $M \pm 2 \text{ S. D.}$ ), instead of 26.10–28.78 in those of *bedfordiae* and 25.12–27.62 of *sikotanensis*.

Molars tall-crowned, rather narrow and weak, third upper molar always complicated, except in very old specimens, with three deep reentrant angles fully extending to the median line and four strongly developed salient angles both on inner and outer sides of the molar. Dentinal spaces of lower molars mostly confluent, closed triangles rarely seen in front of posterior loop in second lower molar, first or anterior external reentrant angle of third lower molar rather deep and extends almost to midline of the tooth, forming nearly symmetrical anterior loop; third lower molar displaced lingually by shaft of lower incisor as in *bedfordiae*.

Measurements of the holotype (in mm): head and body 142.0, tail 63.0, hind foot su 23.0, ear from meatus 15.0, condylobasal length 30.8, zygomatic breadth 17.8, nasals 9.0, diastema 9.2, incisive foramen 6.0, greatest breadth of interparietal 8.4, length of auditory bulla 7.9, bulla/condylobasal length  $\times 100$  25.65, length of upper molars at alveoli 7.8, length of lower molars at alveoli 7.3.

Variations of dimensions: Variations of cranial and external measurements of adult and old males are shown in Table 1.  $M \pm \text{S. E. and S. D.}$  (in



mm) of seven adult and old females are: condylobasal length  $29.79 \pm 0.250$ ,  $0.662$ , zygomatic breadth  $16.95 \pm 0.057$ ,  $0.152$ , greatest breadth of interparietal  $7.80 \pm 0.141$ ,  $0.374$ , length of auditory bulla  $7.44 \pm 0.132$ ,  $0.351$ , bulla/condylobasal length  $\times 100$   $24.97 \pm 0.341$ ,  $0.901$ , length of upper molars  $7.44 \pm 0.103$ ,  $0.274$ , head and body  $133.94 \pm 3.02$ ,  $7.98$ , tail  $60.19 \pm 2.42$ ,  $6.41$ , hind foot su  $21.46 \pm 0.38$ ,  $1.01$ , ear from meatus  $15.00 \pm 0.19$ ,  $0.50$ , tail/head and body  $\times 100$   $44.87 \pm 1.21$ ,  $3.19$ .

Remarks: This new species, *C. rex*, seems to be the largest among the known forms belonging to the *Clethrionomys rufocanus* group. Condylobasal length of *rex* may vary from 28.28 to 32.69mm in limits of  $M \pm 3$  S. D., in which 99.73 per cent of the population is probably included, and by this enormous dimension this species can easily be distinguished from following forms: *C. r. rufocanus* (SUNDEVALL, 1846) from northern Europe, 24.1–27.1 mm (after OGNEV, 1950) or 26.08–28.12 mm ( $M \pm 3$  S. D.,  $N=6$ , culculated after MILLER, 1912), *C. r. irkutensis* (OGNEV, 1924) from Transbaikalia, 26.2–27.3 mm (after OGNEV, 1950), *C. r. vosnessenskii* (POLIAKOV,

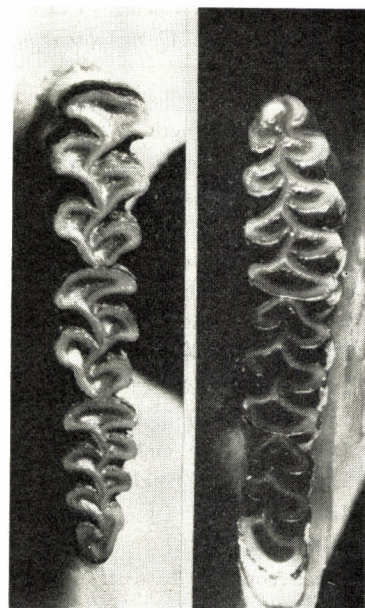


Fig. 3. Left upper and left lower molars of *Clethrionomys rex*, the type.

Table 1. Variations of cranial and external measurements in adult and old male specimens examined.

	<i>Clethrionomys rex</i> sp. nov.				<i>C. rufocanus bedfordiae</i>			
	N	M	S.D.	S.E.	N	M	S.D.	S.E.
Condylobasal length	8	30.51	0.738	0.279	15	26.71	1.036	0.277
Zygomatic breadth	8	17.49	0.422	0.159	16	15.28	0.704	0.182
Length of nasals	8	9.05	0.400	0.151	16	7.63	0.414	0.107
Diastema	29.57 8	9.01	0.327	0.124	17	7.51	0.397	0.099
Incisive foramen	26.9 7	6.39	0.305	0.124	17	5.38	0.449	0.112
Greatest breadth of interparietal	8	7.93	0.449	0.170	16	8.44	0.433	0.112
Length of auditory bulla	8	7.98	0.370	0.140	17	7.34	0.250	0.063
Bulla/CBL $\times 100$	8	25.15	0.303	0.107	15	27.44	0.668	0.172
Interparietal/CBL $\times 100$	8	25.98	1.471	0.556	15	31.61	1.963	0.525
Length of upper molars	8	7.49	0.237	0.089	17	6.82	0.170	0.043
Length of lower molars	7	6.94	0.307	0.125	17	6.52	0.200	0.050
Head and body length	8	135.06	8.026	3.034	17	115.06	8.982	2.245
Length of tail	8	57.81	4.629	1.750	17	50.47	4.533	1.133
Hind foot, cu	8	24.00	1.031	0.389	14	21.41	0.810	0.224
Hind foot, su	8	21.88	1.054	0.398	17	19.79	0.897	0.224
Ear from meatus	8	14.56	0.881	0.333	17	13.96	1.639	0.410
Tail/HB $\times 100$	7	42.69	3.259	1.330	16	43.60	3.178	0.821

28.1  
20.1

Table 2. Coefficient of difference, C. D., between *Clethrionomys rex* sp. nov. and *C. rufocanus bedfordiae* from Hokkaido, based on data shown in Table 1.

	C. D.	Nonoverlap populations
Condylobasal length	2.142	more than 99%
Zygomatic breadth	1.963	96~97%
Length of nasals	1.744	95~96%
Diastema	2.070	more than 99%
Incisive foramen	1.340	91%
Greatest breadth of interparietal	0.578	71~73%
Length of auditory bulla	0.548	69~71%
Bulla/CLB $\times 100$	2.358	more than 99%
Interparietal/CBL $\times 100$	1.639	94~95%
Length of upper molars	1.646	95~96%
Length of lower molars	0.828	75~80%
Head and body length	1.176	88~89%
Length of tail	0.801	75~80%
Hind foot, cu	1.407	92~93%
Hind foot, su	1.614	94~95%
Ear from meatus	0.238	58~60%

1881) from Korea, 25.7–27.8 mm (N=7, after HINTON, 1926), *C. r. shanseius* (THOMAS, 1908) from Shansi, China, 25.3–25.8 mm (N=3, after G. M. ALLEN, 1940), and *C. caesarius* (MILLER, 1908) from Channel Is., 25.0–27.4 mm (N=9, after MILLER, 1912).

From the Japanese forms of *rufocanus* group this species may be clearly distinguished by a following key, although it is useful only to adult and old specimens.

- A. Third upper molar with four prominent salient angles on outer side (no exception in 24 molars examined); anterior loop of third lower molar nearly symmetrical 'spade' shaped, bordered posteriorly by deep reentrant angles both outer and inner sides (no exception in 20 molars); a distinct concavity on antero-upper border of zygomatic root (no exception in 32 examples); lateral bridges of palatine always incomplete (no exception in 15 skulls); second lower molar mostly without closed triangles in front of posterior loop (only one exception in 24 molars); auditory bulla relatively small,  $M \pm 2$  S.D. of bulla index, per cent of length of bulla to condylbasal length, 24.54–25.76; condylbasal length of males varies from 29.03–31.99 mm in about 95.45 per cent of population. Rishiri Island.....*C. rex*
- A'. Third upper molar with three prominent salient angles on outer side (no exception in 58 molars); anterior loop of third lower molar not symmetrical but 'scythe' formed, the external reentrant angle shallow (in 24 among 52 molars the angle very shallow and obsolete); never distinct concavity on antero-upper border of zygomatic root (in 12 among 57 examples a shallow and indistinct concavity observed); lateral bridges of palatine mostly complete (in 7 among 25 skulls incomplete); triangles of second lower molar tend to be closed.
- B. Third upper molar ordinary with three reentrant angles on inner side, but the third angle sometimes very shallow and practically absent, auditory bulla relatively small,  $M \pm 2$  S.D. of bulla index 25.12–27.62 ( $M \pm$  S.E. 26.37  $\pm$  0.623, S.D. 1.080); triangles of second lower molar sometimes closed (in 2 out of 4 molars closed); size larger, variation

of condylobasal length of 4 ♂♂ from Shikotan I.:  $M \pm S.E. 27.90 \pm 0.430$ ,  $S.D. 0.745$  mm (after TOKUDA, 1941\*), specimens from Rishiri I. seem to be much larger, measured 30.3 and 29.9 mm in two fully adult male and female specimens. Shikotan, Daikoku, and Rishiri Is.....*C. sikotanensis* (TOKUDA, 1935)

- B'. Third upper molar nearly always with two reentrant angles on inner side; auditory bulla relatively large,  $M \pm 2 S.D.$  of bulla index 26.10–28.78 ( $M \pm S.E. 27.44 \pm 0.172$ ,  $S.D. 0.668$ ); triangles of second lower molar mostly closed in adults (in 33 out of 36 molars closed, but the dentinal spaces tend to confluent again in old ages); size smaller, variation of condylobasal length of 15 ♂♂:  $M \pm S.E. 26.71 \pm 0.277$ ,  $S.D. 1.036$ .

Hokkaido .....*C. rufocanus bedfordiae* (THOMAS, 1905)

Among the Japanese forms of *rufocanus* group, *rex* seems to be the most primitive, because the molars are rather weak, the dentinal spaces of lower molars are mostly confluent, the third upper molars are complicated, the lateral bridges of palatine are always incomplete as in immature stages, the braincase is relatively small and tail is generally longer. Its characteristic geographical and ecological distributions also seem to reveal the primitive status of this interesting species.

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\* This value is based on data mentioned as 'basal length' by TOKUDA, 1941. But values of the basal length calculated from the photographs, Figs 8–9, Pl. V, of his article, using the zygomatic breadth as a standard, are much shorter than those shown in p. 136. So that the values of TOKUDA are probably those of condylobasal length.